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Recent Trends in University Library Buildings

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The problem of planning university library buildings, although not new, has only recently received the attention it deserves(1). This is evidenced by the several important current volumes on the subject as compared to the scattered material prior to 1939. Perhaps the most thorough investigation ever made of the problems involved in planning university library buildings has been in progress since 1944. It was then that the Cooperative Committee on Library Building Plans met for the first time. This Committee, made up of librarians, architects, and engineers, has met annually ever since to discuss problems common to all the institutions represented who were planning buildings of their own. A summary of these discussions has recently been published(2), as have been the proceedings of most of their annual meetings.

Two procedures in planning new library buildings are currently recommended--using as a consultant an experienced librarian to assist in writing a requirements program from which the architect can work, and holding group discussions between librarians and architects to criticize and suggest changes in plans. The work of the Cooperative Committee reflects the second of these procedures. Cooperative planning can be of great value in preventing the repetition of mistakes which have been common in the past when new buildings were patterned after existing buildings. This is especially important when it is realized that there are at present some 300 college and university library buildings under construction or in various stages of development(3).

If it is possible to designate one main trend in library buildings in the present era, one might call it a trend toward functional interiors -- interchangeable as opposed to fixed function in older buildings. It was not until about 15 years ago that functionalism became an important factor in the design of library buildings. Simpler exterior architecture and less pretentious interiors are now being used. In some instances, however, as at Princeton, it is necessary to use an architectural style that will harmonize with the rest of the campus.

The primary functions of each library are similar in most colleges and universities. It is possible, therefore, to have many points of agreement among librarians which serve as guideposts. The papers(4) presented before the Library Institute at the University of Chicago in 1946, as well as the results of the discussions of the Cooperative Committee, show the present day thinking in the field

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of university library buildings. The present tendency is to place chief emphasis on the relation between the book stack and the reading areas, in other words, the book and the reader. The location of technical processes and other library staff functions is receiving secondary emphasis in the design of buildings. It is this new approach which is determining the character of the present-day plans for new buildings.

Overall Design of the Building

There is at least one point upon which all librarians agree with respect to library buildings. It is the inability of any one plan to meet the needs of more than one college or university. Librarians today realize that the plans for any building are first preceded by a thorough study of the educational relationship of their particular library to the rest of the academic program of their own university. The educational policy of their institution as regards the future is especially important. It is only with this type of study that the librarian can intelligently plan the library building to accommodate shifting emphasis in curricula, and provide for the expansion of the library with that of the university.

A good description of some of the planning that is necessary in thinking about a new library building is aptly given by Metcalf in relating the underlying objectives for the new undergraduate library at Harvard(5). In addition to the objectives, which are necessary to justify a new construction, there are problems of site, building plans, and, not the least, financing. Planning of this nature is not accomplished in a short time. In the case of Harvard, initial consideration for the undergraduate library was begun in 1938, and the building wasn't completed until late 1948. An example of a typical statement of the architectural and engineering features of the proposed library which will be useful in the selection of an architect, as well as useful to the architect, is given by Burchard(6). It is a part of the standards drawn for the new M.I.T. library building. It is necessary for the architect to have such a written program from which to work.

Libraries of large research institutions have at present a normal growth rate of about 4 per cent annually(7). This means doubling in size every 18 to 20 years. This has been found true at Harvard and is no doubt more typical of present growth rates than Rider's estimate of doubling in size every 16 years(8). It is likely also that when libraries become large, growth may be at a smaller rate in the future(9), but certainly in planning a new library building, this factor of growth must be considered. No one has yet made the mistake of an overestimate of future growth of a university library.

To be able to estimate what the future space requirements will be in any one library, it is necessary to analyze the various factors contributing to this growth. Metcalf(10) made the following analysis for the various materials:

a. Newspapers. The average newspaper volume occupies as much stack space as 15 average-sized books. In state libraries and some university libraries newspaper collections may take up to 20 per cent or more of the total stack area. Because of the rapid disintegration of newspaper stock, and because of this large demand of storage space, many libraries are microfilming their collections. For this reason, newspapers which may now require 10 per cent of the total storage space in university libraries probably will take perhaps 5 per cent or less in 20 years.

b. Periodicals and serials of all kinds. This type of material has been increasing in number and in bulk and has become more and more demanding for space.

Because of increased subscription costs and the unavailability of many foreign periodicals which ceased publication during the war, it is possible that libraries will scrutinize their lists more carefully. Because libraries will probably not increase the percentage of their appropriation for periodicals, it is likely that this material will not double in bulk every 16 to 20 years.

c. Public documents. The war years have produced a tremendous bulk of government publications. There may be an increase for the next few years, but it seems doubtful that it will make up a larger percentage of total acquisitions 10 years from now than it does at present.

d. Trade books. These are the backbone of any collection and continue to occupy a larger percentage of space in small university and college libraries than any other material. The geometric growth of libraries will depend, to a large extent, upon the geometric growth of book production.

e. Pamphlets and ephemeral material. No statistical information is available on this type of material although in general it can be said that the bulk of these publications does not represent a serious storage problem. They constitute more of an administrative problem in processing.

Types of Building Construction

New materials and new methods of construction have been introduced in the past decade which will affect library buildings of the future. Underwood(11), in describing some of the ideas in planning new government buildings, lists the following trends in internal construction:

a. Straight and simple corridors for horizontal circulation.

b. Use of more escalators and less elevators. In buildings of 40,000 or more square feet on a floor, four floors can be served efficiently and economically with escalators.

c. More steel frames and less reinforced concrete, thereby using more welding. This will result in lighter buildings.

d. Elimination of "wet" construction, e.g., stone, slabs, bricks, tiles, concrete blocks, and plaster, all of which are materials which use water for mortar or mix. This will gradually be replaced by "dry" construction, viz., panels of sound-insulated metal, light in weight, stiff and rigid, and easy to install, or perhaps glass, plastic, or composition boards.

e. Use of metal cellular floors which permit conduit and wiring to run within them.

f. Ceilings of metal acoustical plank which can easily be removed for servicing electric supply conduits and which permit horizontal air ducts between the ceiling and the floor slab above it.

g. Movable partitions which are only half as thick as the customary tile and plaster, thereby saving floor space and providing flexibility of room arrangement.

h. Resilient floor coverings instead of hard floors.

i. Elimination of ponderous nonfunctional moldings.

More and more interest is being shown in the modular type of construction. This is a method by which flexibility in arrangement of rooms or areas is accomplished through uniform dimensional spacing, particularly of columns. A building designed with such regularity of form can carry essentially the same loads throughout, a very practical way of achieving flexibility. The modules should preferably, but not necessarily, be uniform throughout any one building to achieve maximum flexibility but there is, as yet, no standard size of module. Several of the new university libraries have used this type of construction. The new library at Princeton, for example, has modules 18' by 25'. In order to achieve maximum flexibility it is also necessary to concentrate the areas of vertical transportation -- elevators, stairs, plumbing lines, book lifts, etc. -- in as few immovable core units as is consistent with the requirements of service and of law.

MacDonald suggests, in connection with modular construction, the use of hollow steel columns, girders, and floor members in the structure, to take the place of all or nearly all ducts for air, electric wiring, water pipes, and other services(12). But modular construction can use any standard building method or materials, wet or dry(13). Columns can be reinforced concrete, steel beams, hollow metal tubes or squares, or of other materials or shapes. The floors can be concrete or metal, removable or permanent. Designs can take any form. For example, Princeton and the State University of Iowa library buildings are similar to each other but different from that of M.I.T., though they all use modular construction. In this type of construction, low ceilings of about 8' are desirable to take full advantage of space. In areas where high ceilings are required, the floor panels in one or more modules can be eliminated above those areas. Bean and Ellsworth, in designing typical plans for college and small university library buildings, used ceiling heights of approximately 8'4" and modules 22-1/2' square(14).

Stacks

The areas devoted to book storage account for a large amount of the space in university library buildings. Harvard's collection, for instance, probably occupies about one-fourth of the total library space, as does also the book storage space in Princeton's new library. The storage space in the library of the University of Pennsylvania occupies possibly one-tenth of the total library space(15). On the other hand, very few institutions which make adequate provision for students use as much space for books as for students(16). Space requirements for stacks may be figured, conservatively, on the basis of 2 volumes per cubic foot and 15 volumes per square foot(17). Hanley suggests 10 volumes per square foot for a working collection(18).

The location of the stacks determines to a large extent the design of the building. Among the various designs of library buildings one can find examples of the following stack locations:

a. Rear location in an "H", "T", or "U" shaped building. This permits an abundance of natural light for stacks and carrells, and permits possibilities of expansion. There are several disadvantages to this design. The stack is comparatively far removed from the reading areas. Most books needed by patrons must be procured across the delivery desk. Alterations of the T-shaped and H-shaped buildings to bring books and readers closer together are difficult and expensive.

b. Center location. This permits periphery reading rooms and offices. It is economical to construct and is compact for the shape of the building is compact. Typical of this design are the Library of Congress Annex and the Butler Library at Columbia University. Disadvantages include inflexibility for expansion

of either reading rooms or stacks, a necessary corridor around the stack which permits access to peripheral areas but which also separates the stacks from the reading areas, and the necessity for circuitous travel to reach reading areas on opposite sides of the building.

c. Vertical location of the stacks beneath the reading rooms, housing materials of the same subject as the reading room above it in the case of departmentalized or divisional libraries. The Enoch Pratt Free Library is a typical example. The new M.I.T. library has nearly the same arrangement except that the stacks beneath are not limited to the one subject field, thereby providing enough flexibility to prevent overcrowding in some areas and spaciousness in others. In general, this design does not permit much flexibility.

d. Divisional or compartmentalized location. This provides for the shelving of most of the books on a subject in a subject-division reading room, combining in the one room the storage function and the reading function. Several new libraries, such as those of the Universities of Colorado and Nebraska, have this arrangement and the practice seems to be spreading. In the M.I.T. library this is the chief arrangement, as it is also in the Cleveland and Milwaukee public libraries.

Stack construction costs approximately one dollar per volume in a standard stack(19). The present trend toward functionalism has caused an almost complete disappearance of the core stack in favor of slab floors with free standing stacks. After several years of study of library buildings and plans, the Cooperative Committee came to this conclusion(20):

"A solution lies in the erection of a library in which the building is the stack and the stack is the building and in which all possible space is free and easily adaptable to use as stack, reading or administrative area. Divisional reading rooms, departmental libraries, and small reading areas can be dispersed throughout the stack floors, changed in size as desired, and surrounded with all relevant reading materials."

Several institutions have either built or are planning to build this type, e.g., the Universities of Iowa, Georgia, Princeton, and the Massachusetts Institute of Technology. To achieve this full flexibility it is obvious that construction costs will be somewhat higher. To build reading rooms that are capable of also supporting the greater loads of book stacks requires stronger construction. In the M.I.T. building it is estimated that the increased cost amounted to one per cent of the total cost of the building(21).

Service Areas

The chief function of the university library is, of course, serving its clientele, for without this function there would be no cause for the library to exist. It is only logical, then, that the first consideration in the design of a library building should center around the service points of the library. As was indicated before more library space in research libraries is now given up to readers than to any other one purpose. Reals gives three levels of service to readers which have to be considered in planning a building: supply, guidance, and stimulation(22). Not all libraries will serve all three functions but, whichever functions are included, they will have to be taken into account in designing the building.

It is good planning to have as many of the principal service areas as possible on the main entrance floor. If possible, other service areas should be on the floor

above or below this main floor in order to minimize vertical travel. Adequate provision should be made for stairs, and experience indicates that stairways should not be more than 100' apart to facilitate reader travel from one level to another(23). All libraries, even though departmentalized, will have general reference and circulation rooms. The public catalog used in connection with these rooms must be conveniently located near the circulation desk, bibliographical and reference facilities, and the processing departments. Here a juxtaposition of stacks is necessary for proper service. Other special services, such as the bibliography room and the periodical department, should be located nearby.

The plan of service of a library determines the size of the reference room to a great extent. If the library is arranged by subject divisions, the reference room need not be so large. Also if there is adjacent a general reading room, the reference room need not provide as much seating space. Whatever the size, the reference room should be near the public catalog and relatively near the circulation desk, processing departments, periodical and newspaper collections, and bibliography room. The periodical room, like the reference room, will require more or less space depending upon whether the library is a centralized or departmentalized system. If the library is a completely departmentalized system, the periodical room might be eliminated altogether, the periodicals being distributed according to the subjects of the divisions, and the miscellaneous group possibly being shelved in the reference room.

The circulation desk and lobby should be a focal point of the library. Facilities should be provided for the students waiting to receive the books which they requested, and also for scanning the books. There should be tables in the lobby, and seats facing the desk to enable the waiting group to see the signaling system which notifies them when their books are ready. This area must necessarily be near the public catalog and also should be adjacent to the stacks for efficient service. The size of the lobby will depend upon the local situation but should be large enough to avoid overcrowding, even at peak loads. Staff space must be large enough to accommodate the multiple activities needed for carrying on the work of this department. These activities include circulation records and circulation procedures, sorting of returned books, operation of the book delivery apparatus, movement of book trucks, display of newly added books, and, in some libraries, readers advisory service.

In university libraries, there are two main groups of library users. The group which makes up by far the larger number of patrons consists of the undergraduate students. They represent the traffic of the library. It is this group that is being educated primarily for breadth of knowledge and expansion of culture. Second, there are the users who are adding to the depth of their learning and education, the advanced undergraduate, graduate, and postgraduate students, and faculty, research workers, and others seeking specialized information.

It is important that reading rooms and service areas designed primarily for the undergraduate students be strategically placed to avoid congestion. They should be located so that they are easily accessible, preferably on the main floor near the entrance. Their location should avoid cross traffic from work areas. Provision should be made for ample seating space. Some librarians who have studied the subject have recommended a seating capacity for up to 50 per cent of the student body(24). Other considerations are noise control, carefully designed lighting and heating, and, of equal importance, the creation of an atmosphere which will encourage the use of the library beyond the required readings. Rooms which should be included in the above considerations would be reserve book rooms, housing not only the reserved or required reading references but also books of an undergraduate level, which could give the students a broad cultural background. A much more

appropriate name could be applied to these rooms than reserved book rooms. For example, the State University of Iowa has called a similar room in its library "the Heritage Library."

It should be noted that the undergraduate reading room is being spoken of as being a separate part of the library. Rescuing the undergraduate from the confusion and bewilderment attendant on the multiple activities and collections of a large library is a trend of fairly recent origin and is being followed, in addition to Iowa, by Harvard University through its new Lamont Library, Columbia University, and others. Some of the older library buildings, such as at University of Illinois, have been rearranged so as to provide similar facilities. Thus, the University of Minnesota Library is in an older building with no one separate undergraduate room; it has been recommended immediate steps be taken to correct the deficiency, even to the point of providing quarters outside the main building, if necessary(25).

For the more advanced users of the library it is necessary to provide special services. Such services would include, in addition to the reference, circulation, periodical and newspaper departments, special subject collections, bibliography rooms, seminar rooms, carrells, perhaps studies, and even oases in the stacks. In the larger universities separate rooms are devoted to bibliographies which bring together highly specialized works in an effort to serve scholarly investigation. In addition to the usefulness of the collection to the research worker, it is useful to the library staff itself, particularly the cataloging and acquisition groups, and it therefore should be located near these groups, if possible. Provision should also be made in these rooms for the use of microfilm and microprint.

Seminar rooms are essential for the use of groups of students who need to have discussions or to study together. Primarily their use will be by the graduate and research students, although this varies from institution to institution and their design will be dictated by the local situation. It is a commonly accepted fact that carrells are necessary in college and university libraries. Generally they are located along the periphery of the stacks although several recently designed buildings have the carrells built into the interior of the stacks. Space around reading room walls ordinarily used for books can be used to great advantage for small stalls with individual tables, such as has been successfully done at the Lamont Library at Harvard. Metcalf contends that, as far as cubage is concerned, a small stall in a stack 7-1/2' to 8' high is the most economical method (in terms of space) to care for a reader(26).

In a few institutions we find studies -- areas similar in design to carrells except larger in size. They are intended for use by mature students and faculty engaged in research. The widespread adoption of studies in the design of library buildings has met with some resistance among librarians because of the inability to provide service of this type to more than a selected few. Oases are of recent origin and the use of them at Princeton has apparently met with considerable success. These are spaces designed to break up rather large monotonous stack areas and at the same time, through use of color and comfortable furnishings, provide very convenient locations to facilitate browsing and examination of nearby materials.

The libraries of today are much more than mere houses of books -- "morgues of culture" as one recent writer put it. Modern libraries contain all the media of communications. Of increasing importance are collections of films, records, pictures, maps, manuscripts, material for the blind, music scores, photographically reproduced materials, charts, diagrams, slides, and so on. Each of these materials must be handled in its own special way. If films are available, then it is necessary to provide the facilities to use these films, viz., projectors and suitable

projection and reading areas. The same type of facilities are needed for the use of slides, microfilm, and filmstrips. Some prefer that microfilm be available in the reading room rather than in a separate division of the library(27). This would entail reading and storing facilities throughout the reading room. Provision should also be made for plugging in table phonograph pick-ups in the reading rooms to prepare for extensive use of recordings in the future. At present, records require sound-proofed rooms and record players; in this same area there might be provided radios and even television equipment. In fact, it has been suggested that every new library built will need a room for television, and every existing library will try to set aside such a room(28). The blind require record players and facilities for reading. Maps, charts, and diagrams need special cases and large table areas for their use.

Many of the large university libraries have a sizable collection of rare books and manuscripts. These usually require special treatment in the way of handling, display, air-conditioning, and fire prevention and protection. In addition to these special materials, other special facilities should be provided, including accommodations for exhibition of materials to cultivate new cultural interests. Such facilities should be located in areas where they will be seen by a large percentage of the clientele of the library if the exhibit is of general interest, or in areas most used by the special audience to be reached. To be effective, exhibit areas and facilities should be built according to psychologically proved designs, or much valuable space can be wasted.

Theses, staff publications, and other materials requiring safeguarding usually are kept in stacks protected by steel partitions or wire grills. In some instances these publications can be included in the rare book room. Browsing rooms are important to the library in that they provide another means of exposing students and staff to books which broaden cultural backgrounds as well as provide recreational reading during leisure moments. Their location should be as near to the library traffic as other service areas will permit. Any library of modern design should provide lounge areas where smoking and conversation can be carried on, where even recorded music is played or small informal lectures are given. These areas require proper acoustics, comfortable furnishings, and a pleasant, informal friendly atmosphere.

In order to promote the library as a cultural center, the provision of an auditorium may be helpful. Seating capacities need to be large enough to accommodate meetings of social and literary societies, professional groups, regional and local meetings pertaining to the library profession, and general library staff meetings. The new library building at the University of Nebraska is one of the few which provide for auditorium facilities in the library. The new building at the State University of Iowa will have an auditorium with a seating capacity of 250 people. Other libraries have lounge areas which can be converted to meeting places by the use of folding chairs. There is a dearth of information concerning the incorporation of auditorium facilities in library buildings. Oddly enough the subject is not dealt with at all in either of the two recent books(2,4) on the subject of library buildings.

Archives require special handling in the way of air-conditioning. Normally the location of archives can be on a floor less accessible than other service areas and in a more remote part of the library. Purified air with the proper amount of humidity and of correct temperature must be provided for this area to preserve valuable historical records. Preservation is the keynote for this collection and care must be provided in its handling. In libraries where it is planned to produce photographic reproductions, as well as use them, space must be provided which is

suitable for a photographic laboratory. Some universities provide such facilities apart from the library. Where it is necessary to incorporate these facilities in the library building, the following common requirements should be observed: (a) an area which can be kept clean, well-lighted, and air-conditioned; (b) an ample supply of clean and tempered water, electric power, and drains; (c) a ceiling height up to 11', if required for newspaper microfilming cameras and big enlargers; (d) areas which can be completely darkened; (e) floors which can be washed and which will be impervious to spilled chemicals or water; (f) freedom from building vibration, especially from fans, elevators, or refrigerating compressors; (g) built-in equipment -- benches, sinks, cabinets -- where permanent installations are made; otherwise portable equipment is preferred, to achieve flexibility in arrangement(29).

Staff Facilities

Of secondary emphasis but certainly of primary importance are the areas given over to the administrative and technical functions of the library. The quality of service to the public will depend directly upon the internal organization of the library and the efficiency with which the staff is able to work. Most librarians are too modest in their demands for adequate space for the library staff. The librarian of Princeton has made a study of 30 of the largest libraries and has found that the average was one staff member for each 13,000 volumes. Metcalf suggests that an average of 2,000 cubic feet of space should be allowed for each staff member. This assumes a 16' ceiling, 1,000 square feet for each staff member in the catalog and order departments, with correspondingly less area for the staff working in public rooms, but more area for the administrative staff. On this basis, the total staff area would occupy slightly less than one-third of the total library space devoted to either books or readers(30).

The administrative and reception areas should be planned for an attractive "front office" appearance, professional and dignified. The librarian's office and his reception area should have a variety in furniture, floor covering, and fixtures, rather than making the area look like a miniature reading room with typical library furniture. The area should be a source of pride and prestige, not just for the librarian and his personal staff, but for the entire library staff. If there are assistant librarians or administrative assistants, the arrangement of offices should be such that all can be served by the same reception area. In addition there should be a conference room adjacent to the administrative area. The administrative staff normally house general supplies, and generous space should be provided for this service in the way of storage facilities. If more than two or three clerical helpers are needed in this area, an extra office should be provided for them to reduce the typing noise in the reception room. In instances where a business or accounting officer is on the staff, space for him should be adjacent to or part of the administrative area.

In order to properly plan the technical departments it is necessary to have at hand a detailed list of all the operations and functions of each department and how each of these processes are performed or will be performed in the future. An organizational chart is very useful to show personnel and job relationships. Wheeler and Githens suggest making a functional diagram, a sort of flow chart, showing the relationships between departments(31). The plan should be tested by drawing in routes of communication between departments, or tracing the activities involved in processing a new book added to the library. A continuous line of travel of such a book, without any redoubling of the track, is to be desired.

The growth factor should also be taken into consideration in the technical departments for they must grow with the library. Librarians use the reasonable

standard of 100 square feet of floor space for each worker. This includes space for book trucks, shelving, and reference material. A clerical worker not requiring this additional equipment needs about 60 square feet. Noise control is important in work areas where there are many typewriters. Rubber or cork flooring and acoustical plaster or other sound-absorbent materials can do much in the way of noise absorption. Adequate facilities for books and supplies should be provided in the processing departments. Space need not be provided for materials like old records and files which can go in dead storage. Neither should storage stacks be placed in these areas. Locker space and restrooms are best provided for by a decentralized plan. Lockers are better in an open hall area than in a separate room, to secure proper circulation of air particularly in wet weather with the attendant umbrellas. In recent years the trend has been away from private offices in each department. In ordinary circumstances the only private offices in a library should be those of the top administrative officials. Supervisory control of personnel is best achieved through a close interrelation in working activities in the sharing of the working area by both the management and the staff.

In a suggested priority list of departments to be located on the main floor, Miller gives first place to the reading room, reference department, circulation desk, and public catalog. Second place would go to the catalog department. Book order and receipt activities with typists are given third and fourth place. Periodical checking and receiving might be fifth on the list, with binding as sixth, receiving room as seventh, and exchanges in eighth place(32). As to the catalog department the flow diagram of work (or of a new book) is apt to be more of an assembly line technique than in an order department. Catalogers need ready access to the union catalog, reference materials, and the shelf list. A close relationship of the catalog department to the public catalog is a necessity. A bibliography room should be close at hand to the catalog department.

In any new library provision should be made for a club or lounge room for the staff, to be used for group activities, entertainment of friends, and meeting of visitors. This area should be provided with a rest area and kitchen facilities. Appointments should be colorful, comfortable, and inviting. The location of such facilities should be in a light, airy place, such as might be available on a top floor.

Air Conditioning, Lighting, and Fire Protection

Air-conditioning means the control of temperature, humidity, air motion, air distribution, dust, bacteria, odors, and toxic gases. A library differs from most other large installations in the problem of air-conditioning in that there are two main factors involved -- comfort of humans, and preservation of materials. Fortunately the demands of both factors are very similar in that the conditions meeting the specifications of the one are acceptable, within limits, to the other. Requirements for human comfort vary with the individual, although a comfortable winter temperature for most people is about 70 degrees F., with 77 degrees F. for summer. Humidity of 50% is normally comfortable to most people. Similarly, library materials show little deterioration, in studies thus far made, at temperatures of 65 degrees to 75 degrees F. with humidity at 40 to 50%.

The inclusion of plans to install an air-conditioning system must be weighed carefully. Present-day costs of maintenance of full air-conditioning are high. However, even though it is not planned to use air-conditioning immediately, consideration should be given to suitable provisions for later installations in the way of refrigeration rooms and proper-sized ducts. This was done at Princeton, though the provision for such future installation forced unfavorable alterations in the

design of present ventilating equipment. They expect air-conditioning to be economically and psychologically possible in the foreseeable future; had the provision not been made at the time of the construction of the new building, later costs of installation would be excessive(33).

Gates has estimated that the installation costs of a conventional air-conditioning system in a moderate-sized library at a minimum of 20% of the cost of the building(34). If modular construction is used with the hollow columns and girders recommended by MacDonald, it is possible that installation costs can be cut in half over conventional systems. In most cases it is generally feasible to provide air-conditioning to some rooms for the preservation of treasured materials. This partial air-conditioning poses a problem, however, if the design of the library is for flexibility.

Operating costs vary considerably with the locality, but on a nation-wide basis, yearly operating costs, in cents per square foot of usable floor area, average between 6 to 7 cents for heating and 3 to 4 cents for air-conditioning. One of the newest developments in the air-conditioning field is the use of a triethylene glycol (T.E.G.) system(35). It is primarily an efficient dehumidification agent, which eliminates the need for refrigeration in most conditions, thereby substantially reducing air-conditioning costs. The T.E.G. equipment also has the advantage of automatic air purification and air sterilization, and a high degree of effectiveness of air cleaning. Although no accounts of library installations have been noted, consideration should certainly be given to this new development before arranging for an air-conditioning system in a new library.

Perhaps one of the worst features of most libraries, from the users' standpoint, is their inadequate lighting for reading purposes. Libraries in the past were designed to utilize as much natural light as possible in reading rooms. Lighting conditions, consequently, were best in the daytime and along the outside walls. The present trend is to design the lighting system in such a way as to make it independent of natural lighting and entirely dependent upon artificial lighting. Windows are fast becoming things to look out of and not sources of light. In fact there are no very good arguments for having windows at all in the modern library. The Cooperative Committee suggests that consideration be given to either a windowless building or a building with great glass areas on the north and none on the south. Other variations of these might be the all-glass wall with glare controls, or full glass walls on the north and horizontal strip windows on the sunny sides, with suitable glare controls(36).

In general, it is recommended that there be a minimum of 25 foot-candles of light in rooms in which reading, filing, and working is done. Some writers on this subject have recommended as high as 50 to 60 foot-candles. For reception rooms, wash rooms, and service areas, 10 foot-candles are ample, and in hallways, corridors, passageways, and stairways, a minimum of 5 foot-candles is recommended(37). Such recommendations, however, should be qualified by several things. The quality of lighting as well as the amount of illumination is a factor. The colors of the ceiling, walls, floor, and furniture affect the lighting. The lighting should be uniform and free from harsh shadows and glare. The surrounding area should be adequately lighted, giving the room a low brightness contrast. A ceiling color which gives a reflectance of 75% or more and wall colors of about 50% reflectance should be used. Files, bookcases, decorations, table tops, and floors should be in a light color with a dull finish. The ratio of surrounding lighting to work lighting should be about one to three. As a general rule, light sources should be at least 18 degrees above the horizontal line of vision, preferable between the range of 20 to 30 degrees. If there is partial natural lighting, the windows

should be equipped with venetian blinds or other means of controlling the light to avoid shadows. Natural lighting must be controlled to give the same quality as is required for artificial lighting. There is still no decided advantage of one type of lighting over another, that is, incandescent vs. fluorescent. If the system is designed to give the proper quantity and quality of lighting, the choice is up to the individual. However, a combination of the two may be desirable to counteract the "antiseptic appearance and possible effect of coldness" from the fluorescent lighting, such as is used in the Baker Library at Harvard(38). In any case a competent illumination engineer should be consulted before arrangements are made for any lighting system.

One example of the thorough way an area can be protected from fire is the system installed in the Princeton University Library. Cylinders of carbon dioxide are stored in a basement room and connected to an extinguisher system. Areas which are protected are the receiving room, book-cleaning room, supply room, book-repair shop, janitor's repair shop, manuscript stock room, and manuscript work room. These are all the areas which either store or work with inflammable materials, or places containing materials of high value. As an illustration of the thoroughness of the system, in cases of fire in a protected area, an alarm sounds a warning for evacuation, release valves on the cylinders open, and carbon dioxide rushes to the space afire. In so doing, the ventilating fans are automatically shut off, and doors and ducts are closed. In this way the fire, not being supplied with oxygen, is quickly smothered by the inert gas. The gas does not harm the contents of the rooms(39).

FOOTNOTES

(1) This paper is primarily a survey of the existing literature on the subject. References have been cited where specific items were used, but special acknowledgement should be made to the volume Planning the University Library Building, edited by Burchard, from which much of the material in the section on service areas was taken, and to Miller's paper on "The Technical and Administrative Functions of the Library," for much of the material on staff facilities.

(2) John E. Burchard and others, eds., Planning the University Library Building; a Summary of Discussions by Librarians, Architects, and Engineers (Princeton, N.J.: Princeton Univ. Press, 1949), 145p.

(3) Ralph E. Ellsworth, "Trends in University Library Buildings," Higher Education 5 (May 15, 1949), 207-8.

(4) Herman H. Fussler, ed., Library Buildings for Library Service (Chic.: ALA, 1947), 216p.

(5) Keyes D. Metcalf, "The Undergraduate and the Harvard Library, 1937-47," Harvard Library Bulletin 1 (Autumn 1947), 288-305.

(6) John E. Burchard, "Buildings and Architecture," College and Research Libraries 7 (January 1946), 78-9.

(7) Keyes D. Metcalf, "Spatial Growth in University Libraries: the Future," Harvard Library Bulletin 2 (Spring 1948), 164-78.

(8) Fremont Rider, The Scholar and the Future of the Research Library (N.Y.: Hadham Press, 1944), p. 3 ff.

(9) Keyes D. Metcalf, "Division of Fields of Collecting," College and Research Libraries 6 (September 1945), 417-9.

(10) Keyes D. Metcalf, "Spatial Growth in University Libraries," Harvard Library Bulletin 1 (Spring 1947), 142-6.

(11) Gilbert S. Underwood, "Modern Building Design," in Fussler, op. cit., p. 168-181.

(12) Angus S. MacDonald, "New Possibilities in Library Planning," Library Journal 70 (December 15, 1945), 1169-74.

(13) Donald E. Bean and Ralph E. Ellsworth, Modular Planning for College and Small University Libraries (Privately published, 1948), p. 4.

(14) Ibid.

(15) Metcalf, "Spatial Growth in University Libraries," op. cit., p. 139.

(16) Ibid., p. 151.

(17) Ibid., p. 138.

(18) Edna R. Hanley, College and University Library Buildings (Chic.: ALA, 1939), p. 17.

(19) Metcalf, "Spatial Growth in University Libraries: the Future," op. cit., p. 168.

(20) John E. Burchard and others, eds., Planning the University Library Building, op. cit., p. 60.

(21) Ibid., p. 102.

(22) Ralph A. Beals, "The Plan of Service as It Affects the Library Building," in Fussler, op. cit., p. 18.

(23) John E. Burchard and others, eds., op. cit., p. 108.

(24) Metcalf, "Spatial Growth in University Libraries," op. cit., p. 149.

(25) Keyes D. Metcalf and David H. Clift, Report of a Survey of the University of Minnesota Library for the University of Minnesota (Chic.: ALA, 1949), p. 10-11.

(26) Metcalf, "Spatial Growth in University Libraries: the Future," op. cit., p. 167.

(27) Ralph E. Ellsworth, "The Library Building and the Reader," in Fussler, op. cit., p. 31-2.

(28) A.L.A., Library Public Relations Council, The Use of Television by the Public Library (Chic.: ALA, 1949), p. 11.

(29) Herman H. Fussler, op. cit., p. 84.

(30) Metcalf, "Spatial Growth in University Libraries," op. cit., p. 152.

(31) Joseph L. Wheeler and Alfred M. Githens, The American Public Library Building (N.Y.: Scribner, 1941), p. 335-7.

(32) Robert A. Miller, "The Technical and Administrative Functions of the Library," in Fussler, op. cit., p. 47.

(33) John E. Burchard and others, eds., op. cit., p. 68.

(34) Robert H. Gates, "Modern Air Treatment," in Fussler, op. cit., p. 132-4.

(35) Ibid., p. 134-40.

(36) John E. Burchard and others, eds., op. cit., p. 105.

(37) John O. Kraehenbuehl, "Modern Library Illumination," in Fussler, op. cit., p. 147.

(38) D. T. Clark, "Lighting a Monumental Reading Room," Harvard Library Bulletin 3 (Spring 1949), 301-4.

(39) S. G. Frick, "New Princeton Library Has Eliminated the Fire Hazard," Library Journal 73 (November 1, 1948), 1609-10.

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